

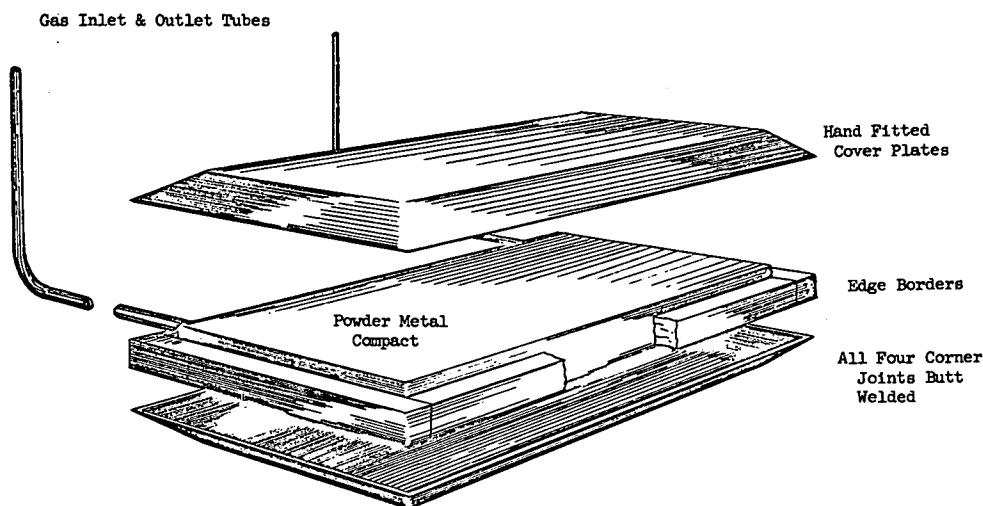
# NASA TECH BRIEF

## *Lewis Research Center*



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### DENSIFICATION OF POWDER METALLURGY BILLETS BY A ROLL CONSOLIDATION TECHNIQUE



ROLL CONSOLIDATION CAN CONFIGURATION

A roll consolidation process utilizing a novel container design has been developed to convert partially densified powder metallurgy compacts into fully densified slabs in one processing step. Basically, this roll consolidation technique consists of combining laboratory state-of-the-art powder metallurgy practices and scaling them up to handle slabs weighing over 45 kg (100 pounds). This technique improves product yield, lowers costs and yields great flexibility in process scale-up; it is a significant improvement in the commercial production of dispersion-strengthened sheet materials.

The densification of powder metallurgy compacts by this technique consists of placing partially densified compacts in a frame or container consisting of suitable metal edge borders welded along the seams. The cavity volume of the frame is between 85 and 100 percent of the volume at full theoretical density of the compact to be inserted. Inlet and outlet gas tubes are positioned at each end of the unit along one edge of the container. The partially densified compact is placed in the frame and hand-fitted cover plates are welded in position top and

bottom to form a leak tight unit. The component parts making up this unit prior to final weld assembly are shown in the figure.

The assembled unit is purged with hydrogen gas to reduce surface oxides and remove entrapped air, and placed in a furnace heated to the appropriate temperature determined by previous forging and/or extrusion practices. It is held in the furnace for a sufficient time to effect a thorough heat soak and attain uniform temperature and proper internal container atmosphere. The inlet and outlet gas tubes are then sealed and pinched off, and the unit is removed from the furnace. The hot unit is rolled on a rolling mill having a roll gap setting equivalent to the thickness of the frame unit thickness. Densification is accomplished in one roll pass. Subsequent passes on the mill at reduced gap settings further reduces the compact (slab) to the desired thickness of sheet material.

For certain materials, it is satisfactory to combine densification and breakdown rolling in the first pass through the mill avoiding the need for separate passes for each purpose.

(continued overleaf)

**NOTES:**

1. Utilization of this roll consolidation technique is applicable to all types of fabricable metallic materials that are produced from a powder metallurgy process. It is particularly applicable to the production of powder metallurgy mill products made from specialty alloys such as dispersion modified metals.

2. The following documentation may be obtained from:  
National Technical Information Service  
Springfield, Virginia 22151  
Single document price \$26.50  
(or microfiche \$0.95)

Reference: NASA CR-120796 (N73-11512), Final Report -- Development of Dispersion Strengthened Nickel-Chromium Alloy (Ni-Cr-ThO<sub>2</sub>) Sheet for Space Shuttle Vehicles

3. Technical questions may be directed to:

Technology Utilization Officer

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21000 Brookpark Road

Cleveland, Ohio 44135

Reference: B73-10040

**PATENT STATUS:**

NASA has decided not to apply for a patent.

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